PATENT SPECIFICATION

NO DRAWINGS

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COMPLETE SPECIFICATION

Improvements in and relating to Textile Yarns

We, HEBERLEIN & Co. A.G., a Swiss Body Corporate of Wattwill, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is concerned with improvements in and relating to textile yarns and particularly with a process for the production of crimped textile yarns.

It has been proposed to produce permanently crimped elastic textile yarns by highly twisting normally twisted or untwisted yarns subjecting them in this condition to a heat setting treatment and back twisting to the initial twist. The process has been used mainly on continuous filament synthetic yarns. It has also been proposed to subject staple fibre yarns, particularly cotton yarns, to this process. However since ordinary cotton yarns are thermoplastic only to a very small extent, it has hitherto not been possible to impart to them a durable crimp in this manner. Attempts have been made to carry out the setting treatment using chemical agents, which is naturally a very complicated and costly method and moreover does not lead to satisfactory results. However, there exists a considerable interest in finding ways of combining the favourable properties of cotton, especially its high absorptivity, with those of crimped yarns of the synthetics. A process has already been proposed according to which ply-yarns of continuous filaments of synthetic and cotton yarns are subjected to a temporary high twisting and setting in the highly twisted condition. Knitted fabrics produced from such ply-yarns have however, a very uneven appearance as well as small cotton knots on the surface, which may be attributed to the fact that the synthetic filaments have a strong tendency to shrink after being made up into knitted and woven fabrics, whilst the cotton yarns retain their original length practically unchanged and therefore slide over the synthetic filaments.

According to the present invention, therefore, there is provided a process for the production of crimped textile yarns wherein a blended spun yarn of substantially non-thermoplastic staple fibres and thermoplastic staple fibres in an amount of at least 10% and not more than 90% by weight based on the total weight of the yarn is temporarily highly twisted and heat set using dry heat at a temperature of at least 150°C in the highly twisted condition.

The component of thermoplastic fibres in the blended spun yarn gives the yarn its crimping properties whilst the component of non-thermoplastic fibres e.g. of natural fibres such as cotton or wool, tend to impart the more desirable characteristics of the latter to the whole yarn.

Also according to the invention there is provided a bulked crimped blended spun yarn comprising at least 10% and not more than 90% (based on the total weight of the yarn) of thermoplastic synthetic staple fibres and substantially non-thermoplastic staple fibres. The thermoplastic staple synthetic fibres may for example be present to the extent of at least 30% preferably from 30 to 70% by weight based on the total weight of the yarn.

A particularly advantageous aspect of carrying out the process according to the invention is the use of dry heat, e.g. hot air, for heat setting. The use of dry heat setting in the present process has the special advantage that substantially less yellowing of the crimped yarn takes place and practically no decrease of the tensile strength as compared to the starting material occurs. The yarns coming from the delivery spool usually pass successively through a first filament feed device, e.g. a pair of rollers or composite rollers, a heater, the twist imparter of the false twist-

ing device, a second filament feed device, and finally arrive at the wind up device.

The heater may conveniently be a tube through which the yarn passes axially and which contains inside the tube, an electric heating coil of resistance wire. Instead of a tube, a heated casing with several heat windings may be used to treat several yarns simultaneously. Alternatively, devices may be used in which the heat setting of the highly twisted yarn is effected by contact with a heated surface, preferably a metal surface, which is electrically heated to the required temperature. The actual setting temperature used in the crimping of the yarn is dependent on the nature of the fibre material and the yarn denier; as a rule, it is from 150 to 250°C when applied to the yarn for from 0.5 to 5 seconds.

By substantially non-thermoplastic stable fibres we mean fibres which have no thermoplasticity or only a very small degree of thermoplasticity, e.g. fibres of natural cellulose, especially cotton, and regenerated cellulose, such as rayon, as well as fibres of animal origin such as wool or schappe silk. The thermoplastic staple fibres may for example be those of a synthetic polymer such as polyamides (e.g. polyhexamethylene adipamide, condensates of ε-amino caproic acid or 11-amino-undecanoic acid), polyesters (e.g. polyethylene glycolterephthalate), vinyl type polymers and copolymers (e.g. polyacrylonitrile or polyvinyl chloride) or polyolefins (e.g. polypropylene). Also suitable are fibres of thermoplastic cellulose derivative e.g. cellulose acetate.

One particularly useful way of effecting the process of the invention is to subject at least two of the blended spun yarns together to the temporary high-twisting in the twist direction opposite to their spinning twist and then as described above, to impart a ply-twist to the yarns after the temporary high-twisting and heat setting. Thus, for example, two yarns with a yarn twist in the Z direction can be temporarily highly twisted together by means of a false twisting device in the S direction beyond the zero, or no twist, point, and then be plied in the S or Z direction. By this simultaneous high-twisting of at least two blended spun yarns, the danger of the yarns breaking or loosening when passing the zero point is avoided. By imparting a final ply-twist in the twist direction of the high twisting, the distortion of the yarn is decreased and an increase is effected in the bulkiness of the yarns. By imparting a final ply-twist in the direction opposite to that of the high-twisting, the elasticity of the yarn is increased and also an increase of the bulkiness is achieved, provided the high-twist direction and the initial spinning twist direction of the yarn are in the same sense. Likewise, an individual crimped yarn can be partially untwisted in the direction opposite to that of its yarn twist.

In certain cases, especially if the component of thermoplastic fibres in the blended spun yarns is relatively low, the latter can be impregnated before or during the high-twisting with a solution of a condensable resin-forming substance, e.g. a methylol compound of urea, a urea derivative or melamine. Blended spun yarns containing cellulose fibres can, after the temporary high-twisting, also conveniently be treated with an alkali solution of mercerising strength, whereby a certain amount of shrinkage of the cellulose fibres and thus an accentuation of the crimping occur.

In order that the invention may be well understood the following examples are given by way of illustration only:—

EXAMPLE 1.

Two yarns with English Yarn No. Ne40/1 and a spinning twist of 866T/m Z, each consisting of 2/3 staple fibres of polyethylene glycol terephthalate and 1/3 of cotton, are passed together through a conventional false twisting machine under the following conditions: The two yarns are temporarily high-twisted together to about 1800 T/m in the S direction and in the highly twisted condition heated with hot air at 230°C for 3.5 seconds. The incoming speed of the yarns into the false twisting device is about 1% higher than the outgoing speed. The two yarns are twisted together with two further similar yarns treated in the same manner, with 380 T/m in the Z direction. The resulting plied yarn has the advantages of natural fibres and of synthetic fibres, namely a good elasticity, wash resistance, a very good absorbtion as well as a soft-wool-like hand.

EXAMPLE 2

Two yarns with English yarn number Ne36/1 and a spinning twist of 750 T/mZ, each consisting of 1/3 of polyacrylonitrile staple fibres and 2/3 of cotton are impregnated with the following aqueous solution and then dried at a room temperature of 22°C (65% relative air humidity.

60 gr/lt	Dimethylolethyleneurea
6 gr/lt	Zinc nitrate
5 gr/lt	Ceranin HC 42 (substantive softener)
1 gr/lt	Triton X100 (non-ionic wetting agent)

The two thus treated yarns are passed together through a false twisting device, in which they are temporarily high-twisted with 2000 T/m in the S direction and treated in this condition for 3.5 seconds to a temperature of 230°. The incoming speed of the yarns into the false twisting device is smaller than the outgoing speed by 5%. The two yarns are then plied with 470 T/m in S direc-

tion; the resulting plied yarn shows a high flexibility combined with a good elasticity, a good absorptivity and a wool-like hand.

EXAMPLE 3

Two yarns with English yarn number Ne60/1 and a spinning twist of 960 T/m Z, each consisting of 50% of staple fibres of polyhexamethylene adipamide and 50% of rayon, are plied with 960 T/m in the S direction and the thread subjected to a false twisting process, in which it is temporarily highly twisted with about 1000 T/m in the S direction and treated in the highly twisted condition at a temperature of 185°C for 2.5 seconds. The incoming speed of the yarn into the false twisting device and/the outgoing speed are equal. The thus treated ply-yarn shows good elastic properties, good absorbtivity and a wool-like hand.

EXAMPLE 4

Two yarns with metric yarn number Nm25/1 and a spinning twist of 490T/m S each consisting of 2/3 of polypropylene staple fibres and 1/3 of wool are passed together through a conventional false twisting machine under the following conditions. The yarns are temporarily highly twisted with 1200 T/m in the Z direction and in the highly twisted condition heated at a temperature of about 150°C for 3.5 seconds. The incoming speed of the yarns into the false twisting device and the outgoing speed therefrom are equal. Two further similar yarns were together temporarily highly twisted on a false twisting machine with about 720 T/m in the S direction and set under the same conditions as the first-named yarns. The two pairs of thus treated yarns are then combined together with 200T/m in the S direction. A thread without tendency to distortion is obtained which is particularly suitable for hand knitting purposes, with good elastic properties and a good heat retaining capacity.

EXAMPLE 5

Two yarns with metric yarn number Nm45/1 and a spinning twist of 650T/m S, each consisting of 50% of staple fibres of polyhexamethylene adipamide and 50% of silk staple fibres (Schappe) are treated on a false twisting machine under the following conditions. The yarns are temporarily highly twisted with 1400 T/m in the Z direction and in the highly twisted condition heated at a setting temperature of 230°C for 3.5 seconds. The ingoing speed of the yarn into the false twisting machine being higher than the outgoing speed by 1%. The thus treated yarns are then plied to 440T/m S. A ply-yarn is obtained having good elastic properties, a soft hand and a modest gloss.

WHAT WE CLAIM IS:—

1. A process for the production of crimped textile yarns wherein a blended spun yarn of substantially non-thermoplastic staple fibres and thermoplastic staple fibres is an amount of at least 10% and not more than 90% by weight based on the total weight of the yarn is temporarily highly twisted and heat set using dry heat at a temperature of at least 150°C in the highly twisted condition.

2. A process according to claim 1 in which cellulose fibres are used as the substantially non-thermoplastic staple fibres.

3. A process according to claim 1 or claim 2 in which the thermoplastic staple fibres used are synthetic fibres.

4. A process according to any of claims 1 to 3 in which the thermoplastic staple fibres used are cellulose derivative fibres.

5. A process according to any of the preceding claims in which the thermoplastic fibres in the blended spun yarn are present in an amount of at least 30% by weight based on the total weight of the yarn.

6. A process as claimed in claim 5 in which said thermoplastic fibres are present in an amount of from 30 to 70% by weight based on the total weight of the yarn.

7. A process according to any of the preceding claims in which the blended spun yarn is impregnated before or during the high-twisting with a solution of a condensable resin-forming substance.

8. A process as claimed in claim 7 wherein the condensable resin forming substance is a methylol compound of urea, a urea derivative or melamine.

9. A process according to any of the preceding claims in which the blended spun yarn is one containing a natural or regenerated cellulose or cellulose derivative fibre and the yarn is treated after the temporary high-twisting with an alkali solution of mercerising strength.

10. A process according to any of the preceding claims in which at least two blended spun yarns are used and said yarns are subjected together to the temporary high-twisting in a twist direction opposite to that of the yarn spinning twist.

11. A process according to claim 10, in which a ply-twist is imparted to the yarns after the temporary high-twisting.

12. A process according to any of claims 1 to 10 in which a single blended spun yarn subjected to a temporary high-twisting, is partially untwisted in the direction opposite to the direction of its yarn spinning twist.

13. A process according to any of the preceding claims, in which the blended spun yarn is heat set using a tube through which the yarn passes axially and which contains inside the tube, an electric heating coil of a resistance wire.

14. A process as claimed in any of claims 1—12 in which the blended yarn is heat set by contact with a heated metal surface.

15. A process according to any of the preceding claims, in which the blended spun yarn is heat set at from 150 to 250°C for from 0.5 to 5 seconds.

16. A process as claimed in claim 1 substantially as herein described with reference to the foregoing examples.

17. A crimped blended spun yarn whenever produced by a process as claimed in any of the preceding claims.

18. A fabric or garment whenever containing a blended spun yarn as claimed in claim 17.

19. A bulked twist-crimped blended spun yarn comprising at least 10% and not more than 90% (based on the total weight of the yarn) of thermoplastic synthetic staple fibres and substantially non-thermoplastic staple fibres.

20. A yarn as claimed in claim 19 wherein the non-thermoplastic staple fibres are cellulose fibres.

21. A yarn as claimed in claim 19 or claim 20 wherein the thermoplastic synthetic staple fibres are polyamide staple fibres or polyester synthetic fibres.

22. A yarn as claimed in any of claims 19 to 21 wherein the thermoplastic staple fibres are present to the extent of at least 30% by weight based on the total weight of the yarn.

23. A yarn as claimed in claim 22 wherein the thermoplastic staple fibres are present to the extent of from 30% to 70% by weight, based on the total weight of the yarn.

24. A yarn as claimed in any of claims 19 to 23 impregnated with a condensed resin.

25. A yarn as claimed in claim 24 wherein the condensed resin is derived from a methylol compound of urea, a urea derivative or melamine.

26. A yarn as claimed in any of claims 19 to 25 having a tensile strength substantially equal to that of the untreated yarn.

27. A plied yarn comprising two or more yarns as claimed in any of claims 19 to 26.

28. A bulked twist-crimped yarn as claimed in claim 19 substantially as herein described with reference to the foregoing examples.

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